IT ARCHITECTURE SUPPORT FOR DON CIO

Rex Buddenberg, Senior Lecturer
Information Systems Academic Group
Sponsor: Department of the Navy Chief Information Officer

OBJECTIVE: Provide support for DON CIO efforts including architecture development, hosting IPTs and various networking initiatives.

DoD KEY TECHNOLOGY AREAS: Command, Control, and Communication

KEYWORDS: IT Architecture

INTEROPERABILITY, ARCHITECTURE, AND PLANNING SUPPORT TO SSC CHARLESTON

Rex Buddenberg, Senior Lecturer
Information Systems Academic Group
Sponsor: Space and Naval Warfare Systems Center-Charleston

OBJECTIVE: To provide support for the fleet NOC and related projects

DoD KEY TECHNOLOGY AREAS: Command, Control and Communications

KEYWORDS: IT Architecture

SIMARMY/MANPOWER LEADERSHIP (SAMPLE): A PERSONNEL BATTLEFIELD DECISION SUPPORT SYSTEM FOR MANPOWER POLICY ANALYSIS

Daniel R. Dolk, Professor
Information Systems Academic Group
Sponsor: U. S. Army Center for Land Warfare

OBJECTIVE: Develop and conduct a business war game for the U.S. Army manpower community to study the effects of various decision policies on intra - and inter-agency connectivity.

SUMMARY: This project was conducted in team ship with Purdue University, using their Synthetic Environment for Analysis and Simulation (SEAS) platform to build a business war game for U.S. Army manpower agencies. A proof-of-concept exercise called Firm Handshake was built for the following Army teams: Force and Policy Structure, Recruiting, Retention, and Training. The one-day exercise was conducted in the WAIC in Arlington, VA on 27 January 2000. Despite numerous hardware and software incompatibilities between Purdue's and WAIC's configurations, the to play enough of the game to see what benefits were available. Primary amongst those were the ability to see how other teams thought and strategized, and the ability to see what conflict and coordination points arose amongst teams in the process of implementing various decision policies. The U.S. Army Recruiting Command (USAREC) subsequently has funded a complete business war game for studying their recruiting policies.

THESIS DIRECTED:

Zimmerman, J., "Business Wargaming: Applications for Marine Corps Manpower Policy Decisions," Masters Thesis, Naval Postgraduate School, March 2000.

DoD KEY TECHNOLOGY AREAS: Modeling and Simulation

KEYWORDS: Agent-based Simulation, Business Wargame

SIMMANPOWER/POLICY (SMP): A BUSINESS WARGAME SYSTEM FOR USMC MANPOWER POLICY ANALYSIS

Daniel R. Dolk, Professor
Information Systems Academic Group
Sponsor: U. S. Marine Corps

OBJECTIVE: Develop and conduct a business war game for the U.S. Marine Corps manpower community to study the effects of various decision policies on intra- and inter-agency connectivity.

SUMMARY: This project was conducted in team ship with Purdue University, using their Synthetic Environment for Analysis and Simulation (SEAS) platform to build a business war game for U.S. Marine Corps manpower agencies. A proof-of-concept exercise called SimMarineCorps was built for the following Marine Corps teams: Force and Policy Structure, Recruiting, Retention and Staffing, and Training. The one-day exercise was conducted USMC Headquarters in Quantico, VA on 27-28 October 2000. Despite numerous hardware and software incompatibilities between Purdue's and USMC's configurations, the participants were able to play enough of the game to see what benefits were available. Primary amongst those were the ability to see how other teams thought and strategized, and the ability to see what conflict and coordination points arose amongst teams in the process of implementing various decision policies. USMC will observe progress on the USAREC war game exercise before deciding to what extent they want to pursue further development of this technology.

THESIS DIRECTED:

Zimmerman, J., "Business Wargaming: Applications for Marine Corps Manpower Policy Decisions," Masters Thesis, Naval Postgraduate School, March 2000.

DoD KEY TECHNOLOGY AREAS: Modeling and Simulation

KEYWORDS: Agent-based Simulation, Business Wargame

A PERSONNEL MEASUREMENT SYSTEM FOR PERSONNEL ACCOUNTING INVENTORY AND NEC REUTILIZATION TRACKING (PAINT)

Daniel R. Dolk, Professor
Information Systems Academic Group
Sponsor: Naval Personnel Command

OBJECTIVE: Develop a data warehouse-driven system for analyzing multidimensional data pertaining to reutilization of Navy enlisted personnel.

SUMMARY: We developed a single user OLAP application for the Aviation Enlisted Community Manager (PERS-404) to investigate NEC reutilization statistics for enlisted personnel with aviation-related NEC designators. The first step was to build a Microsoft Access database extract of the Enlisted Master File. We then used Cognos Transformer and Powerplay products to construct three different data cubes related to NEC reutilization. Each cube contained a different definition of NEC reutilization. With the cubes built, the ECM was able to "browse" through data in a multidimensional way that previously required a month or more of manual work to accomplish.

THESIS DIRECTED:

Conde, D.J. and Crownover, C. A., "Towards Reengineering the United States Navy Manpower and Personnel Systems – A Data Warehouse Approach," Masters Thesis, Naval Postgraduate School, March 2000.

DoD KEY TECHNOLOGY AREAS: Computing and Software

KEYWORDS: OLAP, NEC, Reutilization, Datacube

USAREC RECRUITING STRATEGIC VISION PROGRAM (RSVP) WARGAME SIMULATION FOR STRATEGIC PLANNING AND DECISION SUPPORT

Daniel R. Dolk, Professor
Information Systems Academic Group
Sponsor: U. S. Army Recruiting Command

OBJECTIVE: This is a two-part project: (1) Create and conduct a reusable, multi-player business war game simulation for the U.S. Army recruiting leadership. The purpose of this simulation is to explore strategic planning dimensions of the recruiting organization in the Army. (2) Develop a recruit market simulation allowing USAREC to "test drive" new recruitment products without having to conduct expensive national tests.

SUMMARY: Part 1 of this project is in progress. Scenarios, players, agents, and agent attributes have been identified, and Web-based software interfaces are under development. Databases are being mined for computing the necessary behavior utility functions for each agent type. The simulation exercise is scheduled for delivery during August 2001. Part 2 of the project will be initiated during the summer of 2001.

DoD KEY TECHNOLOGY AREAS: Modeling and Simulation

KEYWORDS: Agent-based Simulation, Business War Game

KNOWLEDGE DISCOVERY AND DATA MINING FOR SPACE-BASED RECONNAISSANCE

Magdi N. Kamel, Associate Professor
Information Systems Academic Group
Sponsor: Center for Reconnaissance Research

OBJECTIVE: The overall objective of this research is to conduct a detailed survey of knowledge discovery and data mining techniques, identify those techniques that are relevant for space-based reconnaissance, and propose formal techniques for selecting optimal knowledge discovery and data mining techniques from available alternatives.

DoD KEY TECHNOLOGY AREAS: Computing and Software

KEYWORDS: Knowledge Discovery, Data Mining, Data Visualization

DEVELOPMENT OF AN ADVANCED PROOF-OF-CONCEPT WORLD WIDE WEB PROTOTYPE APPLICATION FOR ONLINE RECRUITING

Magdi N. Kamel, Associate Professor
Information Systems Academic Group
Sponsor: Office of the Secretary of Defense and U.S. Military Entrance Processing Command

OBJECTIVE: The objective of this research is to develop and advanced proof-of-concept World Wide Web prototype application to support prospecting, attracting, screening, closing the sale, and processing of new Navy recruits.

SUMMARY: The effort for the current reporting period included completing the following tasks:

- Analysis and design of the main components and features
- Development of a planning, requirements specifications, and design document
- Setting up staffing, operating an in-house web research and application development lab

DoD KEY TECHNOLOGY AREAS: Computing and Software

KEYWORDS: Application Development, World Wide Web, Internet, Prototyping, e-business, Military Recruiting

REQUIREMENTS SPECIFICATIONS AND ARCHITECTURE FOR A WORLD WIDE WEB PROTOTYPE APPLICATION FOR ONLINE RECRUITING

Magdi N. Kamel, Associate Professor
Information Systems Academic Group
Sponsor: Defense Logistics Agency

OBJECTIVE: The objective of this research is to develop the requirements specifications and architecture for a World Wide Web prototype application for online recruiting to attract and encourage young people to learn about, explore, and apply for Navy jobs compatible with their interests, work values, and qualifications in an appealing, exciting, comfortable, and reliable environment.

DoD KEY TECHNOLOGY AREAS: Computing and Software

KEYWORDS: Application Development, World Wide Web, Internet, E-Commerce, Military Recruiting

SOFTWARE QUALITY CONTROL AND PREDICTION MODEL

Norman Schneidewind, Professor
Information Systems Academic Group
Sponsor: Jet Propulsion Laboratory

OBJECTIVE: Develop a Quality Control and Prediction Model.

SUMMARY: We develop a quality control and prediction model for improving the quality of software delivered by development to maintenance. This model identifies modules that require priority attention during development and maintenance by using Boolean discriminant functions. The model also predicts during development the quality that will be delivered to maintenance by using both point and confidence interval estimates of quality. We show that it is important to perform a marginal analysis when making a decision about how many metrics to include in a discriminant function. If many metrics are added at once, the contribution of individual metrics is obscured. In addition, the marginal analysis provides an effective rule for deciding when to stop adding metrics. We also show that certain metrics are dominant in their effects on classifying quality and that additional metrics are not needed to increase the accuracy of classification. Related to this property of dominance is the property of concordance, which is the degree to which a set of metrics produces the same result in classifying software quality. A high value of concordance implies that additional metrics will not make a significant contribution to accurately classifying quality; hence, these metrics are redundant. Data from the Space Shuttle flight software are used to illustrate the model process.

PUBLICATIONS:

Schneidewind, N.F., "Investigation of Logistic Regression as a Discriminant of Software Quality," *Proceedings of the 7th International Software Metrics Symposium*, London, England, 4-6 April 2001, 10 pp.

Schneidewind, N.F., "Data Analysis of Software Requirements Risk," *Proceedings of the European Software Control and Metrics*, 2-4 April 2001, London, England, 10 pp.

Schneidewind, N.F., "Software Maintenance," in *Encyclopedia of Computer Science*, 4th ed. Anthony Ralston, Edwin D. Reilly, David Hemmendinger, eds., Pub: Nature Publishing Group, London (ISBN 0-333-77879-0); Grove's Dictionaries, USA, 2000, pp. 1624-1627.

Schneidewind, N.F. and Sahinoglu, M., Tutorial Notes, "New Advances in Software Reliability Modeling," *Proceedings of The Fifth Biennial World Conference on Integrated Design and Process Technology*, Dallas, TX, 6 June 2000.

Schneidewind, N.F., "Software Quality Control and Prediction Model for Maintenance," *Annals of Software Engineering*, Baltzer Science Publishers, May 2000, pp. 79-101.

PRESENTATIONS:

Schneidewind, N.F., "Investigation of Logistic Regression as a Discriminant of Software Quality," 7th International Software Metrics Symposium, London, England, 4-6 April 2001.

Schneidewind, N.F., "Data Analysis of Software Requirements Risk," European Software Control and Metrics, London, England, 2-4 April 2001.

Schneidewind, N.F., "The Interaction of Software Reliability Engineering (SRE) and Maintenance: Opportunities for Collaboration and Integration," International Symposium on Software Reliability Engineering and International Conference on Software Maintenance, San Jose, CA, 11 October 2000.

Schneidewind, N.F. and Sahinoglu, M., "New Advances in Software Reliability Modeling," The Fifth Biennial World Conference on Integrated Design and Process Technology, Dallas TX, 6 June 2000.

DoD KEY TECHNOLOGY AREAS: Computing and Software

KEYWORDS: Software Metrics; Software Maintenance; Modeling

ON THE REPEATABILITY OF METRIC MODELS AND METRICS ACROSS SOFTWARE BUILDS

Norman Schneidewind, Professor
Information Systems Academic Group
Sponsor: National Aeronautics and Space Administration-Jet Propulsion Laboratory

OBJECTIVE: Investigate whether models and metrics are being repeatable across the builds of a software system.

SUMMARY: Over the past several years we have developed the following metrics models: Boolean discriminate functions (BDFs) for classifying quality; Kolmogorov-Smirnov distance for estimating metric critical values; various derivative calculations for assessing the quality that could be achieved with various levels of quality control and inspection; a stopping rule for deciding how many metrics to use in a discriminate function; point and confidence interval estimates of quality; Relative Critical Value Deviation metrics for indexing quality; and non-linear regression functions for predicting quality. We would like these models and metrics to be repeatable across the n builds of a software system. The great advantage of repeatability is that models and metrics only need to be developed and validated once on build 1 and then applied n-1 times without modification to subsequent builds, with considerable savings in analysis and computational effort. In practical terms, this approach involves using the same model parameters (e.g., metrics critical values) that were validated and applying them unchanged on subsequent builds. The disadvantage is that the quality and metrics data of builds 2,..., n, which varies across builds, is not utilized. We make a comparison of this approach with one that involves validating models and metrics on each build

i and applying them only on build i+1, and then repeating the process. The advantage of this approach is that all available data are used in the models and analysis but at considerable cost in effort. We report on experiments involving large sets of discrepancy report and metrics data on the Space Shuttle flight software, where we compare the predictive accuracy and effort of the two approaches for BDFs, critical values, derivative quality and inspection calculations, and stopping rule.

PUBLICATIONS:

Schneidewind, N. F., "The Interaction of Software Reliability Engineering (SRE) and Maintenance: Opportunities for Collaboration and Integration," *Proceedings of Industry Day, International Symposium on Software Reliability Engineering and International Conference on Software Maintenance*, cigital, San Jose, CA, 11 October 2000, pp. 121-122.

Schneidewind, N. F., "On the Repeatability of Metric Models and Metrics Across Software Builds," *Proceedings of the Eleventh International Symposium on Software Reliability Engineering*, IEEE Computer Society Press, Los Alamitos, CA, 8-10 October 2000, pp. 234-245.

Schneidewind, N. F., Tutorial Notes, "Measuring and Evaluating the Development and Maintenance Process Using Reliability, Risk, Test, and Complexity Metrics," Eleventh International Symposium on Software Reliability Engineering, IEEE Computer Society Press, Los Alamitos, CA, 8-10 October 2000, 30 pp.

PRESENTATIONS:

Schneidewind, N. F., Tutorial Notes, "Introduction to Software Reliability with Space Shuttle Example," 2001 Reliability and Maintainability Symposium, IEEE Reliability Society, Philadelphia, PA, 23 January 2001, 29 pp.

Schneidewind, N. F., Tutorial, "Introduction to Software Reliability with Space Shuttle Example," 2001 Reliability and Maintainability Symposium, IEEE Reliability Society, Philadelphia, PA, 23 January 2001.

Norman F. Schneidewind, N. F., Tutorial, "Measuring and Evaluating the Development and Maintenance Process Using Reliability, Risk, Test, and Complexity Metrics," Eleventh International Symposium on Software Reliability Engineering, 8 October 2000, San Jose, CA.

Schneidewind, N. F., "Can Metrics be Applied Across a Set of Releases or Sites?," The International Workshop on Empirical Studies of Software Maintenance '2000, San Jose, CA, 14 October 2000.

Schneidewind, N. F., "The Interaction of Software Reliability Engineering (SRE) and Maintenance: Opportunities for Collaboration and Integration," Industry Day, International Symposium on Software Reliability Engineering and International Conference on Software Maintenance, cigital, San Jose, CA, 11 October 2000.

Schneidewind, N. F., "On the Repeatability of Metric Models and Metrics Across Software Builds," Eleventh International Symposium on Software Reliability Engineering, IEEE Computer Society Press, Los Alamitos, CA, 8-10 October 2000.

DoD KEY TECHNOLOGY AREAS: Computing and Software

KEYWORDS: Software Metrics, Software Maintenance, Modeling

DEVELOPING THE NEXT GENERATION IEEE DEPENDABILITY STANDARD: IEEE 982 STANDARD DICTIONARY OF MEASURES OF THE SOFTWARE ASPECTS OF DEPENDABILITY

Norman Schneidewind, Professor
Information Systems Academic Group
Sponsor: IEEE Standards Board

SUMMARY: This first phase of the project involves the development of measures to address reliability, maintainability, and availability. The second phase will address security, integrity, and confidentiality. This standard builds upon the IEEE 982.1 Standard Dictionary of Measures to Produce Reliable Software and the companion 982.2 Guide, but will delete outdated measures, modernize the standard with object-oriented measures, and modify measures where appropriate. Because 982 was originally issued in 1988 and has not been revised since then, much of it is obsolete. Thus, there is the need to both update existing measures and to include new measures that reflect developments in software technology since 1988. In revising 982, we are following the recommendations of the IEEE Software Reliability Standards Planning Group as follows:

- Provide specific criteria on how a measure is chosen for inclusion in the dictionary (e.g., some minimum number of recognized uses, validation of a measure with respect to quality factors, or demonstrated or potential utility of the measure in producing reliable software).
- Perform a measure-by-measure review of the items in the dictionary using the stated criteria.
- Identify and incorporate, where appropriate, new measures that have appeared since the original document (e.g., object-oriented, architectural design, process).
- Formulate, where possible, generic measure classes and categorize the existing 982 measure as well as newly defined measures into these classes. The goal of this exercise is to reduce the number of document sections. Example measure classes may be complexity, process, reliability, risk, etc.
- Address major negative comments from the reaffirmation ballot held in 1995.
- Integrate 982 with ISO/IEC 9126 Views of Software Quality and Evaluation Process Model.

PRESENTATION:

Schneidewind, N. F., Tutorial Notes, "A Roadmap To Distributed Client-Server Software Reliability Engineering," Quality Week 2000, San Francisco, CA, 30 May 2000.

DoD KEY TECHNOLOGY AREAS: Computing and Software

KEYWORDS: Standards, Software Reliability

THE RUTHLESS PURSUIT OF THE TRUTH ABOUT COTS

Norman Schneidewind, Professor
Information Systems Academic Group
Sponsor: National Aeronautics and Space Administration-Jet Propulsion Laboratory

OBJECTIVE: Develop a realistic model COTS acquisition and deployment.

SUMMARY: We expose some of the truths about COTS, discounting some exaggerated claims about the applicability of COTS, particularly with regard to using COTS in safety critical systems. Although we agree that COTS has great potential for reduced development and maintenance time and cost, we feel that the advocates of COTS have not adequately addressed some critical issues concerning reliability, maintainability, availability, requirements risk analysis, and cost. Thus, we illuminate these issues, suggesting solutions in cases where solutions are feasible and leaving some questions unanswered because it appears that the questions cannot be answered due to the inherent limitations of COTS. These limitations are present because there is inadequate visibility and documentation of COTS components.

PUBLICATION:

Schneidewind, N. F., "The Ruthless Pursuit of the Truth about COTS," *Proceedings of the North Atlantic Treaty Organization, Commercial-Off-The-Shelf Products in Defense Applications*, Information Systems Technology Panel (IST), Brussels, Belgium, 3-5 April 2000, pp. 17-1-17-9.

PRESENTATION:

Schneidewind, N. F., "The Ruthless Pursuit of the Truth about COTS," North Atlantic Treaty Organization, Commercial Off-The-Shelf Products In Defense Applications, Information Systems Technology Panel (IST), Brussels, Belgium, 3-5 April 2000.

DoD KEY TECHNOLOGY AREAS: Computing and Software

KEYWORDS: COTS, Software Cost, Reliability, Maintainability, Availability